

What is claimed is:

1. A method for predictively encoding digital video sequences, comprising:

dynamically determining the resolution of a current frame being encoded and outputting the determination, the selection being based on statistical and coding information of a plurality of frames, including at least one previous frame and the current frame;

selecting encoding parameters and encoding a current frame at a chosen resolution, wherein the encoding parameter selection step takes into account the determination of the dynamic resolution selection step in determining the encoding parameters.

2. The method of claim 1, wherein the statistical information includes scene-change information and estimated motion information, and the coding information includes a measure of the quantization used by the frames and a measure of the availability of bits.
3. The method of claim 2, further including the step of measuring the availability of bits by determining the decoder buffer fullness.
4. The method of claim 2, wherein the dynamic resolution is further based on functional conditions based on the statistical and coding information, on the basis of which the resolution selection is performed are different for a low-to-high resolution switch as compared to a high-to-low resolution switch.
5. The method of claim 3, further including the step of taking the output of the dynamic resolution selection step by coding the current frame non-predictively if the dynamic resolution selection step determines that the current frame be coded

at a different resolution than the immediately preceding frame.

6. The method of claim 3, further including the step of taking the output of the dynamic resolution selection step by coding the current frame in a combined predictive and non-predictive fashion, with non-predictive coding favored, the decision between predictive and non-predictive coding taken on the basis of frame statistics for a plurality of previous frames and the current frame, if the dynamic resolution selection step determines that the current frame be coded at a different resolution than the immediately preceding frame.
7. The method of claim 6, wherein the statistics include an estimate of the motion, the estimate being based on motion information including the energy of the motion-compensated residual of the current frame.
8. The method of claim 4, further including the step of determining if a high-to-low resolution switch being affected is given by the following condition, the switch being affected if the condition C_1 evaluates to TRUE

$$C_1 = \{ \{Q > T_Q\} \&& \{M > T_M\} \} \text{ II } \{B_{dec} < T_B\}$$

where Q is a measure of the quantization scales used to encode a plurality of previous frames, M is a measure of the motion present in a plurality of previous frames and the current frame, B_{dec} is a measure of the decoder buffer fullness and T_Q , T_M and T_B are preset thresholds.

9. The method of claim 8, wherein the quantization measure is based on a rolling average of the quantization scales of a plurality of previous frames and the predicted quantization scale of the current frame.
10. The method of claim 8, wherein the quantization measure is based on a rolling

average of the quantization scales of a plurality of previous frames, further the motion estimate is based on the rolling average of the motion measure of an individual frame, the measure being based on the energy of the motion-compensated residual of the frame and the motion vector magnitudes for the frame.

11. The method of claim 4, further including the step of determining if a low-to-high resolution switch being affected is given by the following condition, the switch being affected if the condition C_2 evaluates to TRUE

$$C_2 = \{Q \cdot M^2 > T_{QM}\} \&\& \{B_{dec} > T_{B2}\} \&\& \{F_{curr} - F_{sc} > T_{sc}\}$$

where Q is a measure of the quantization scales used to encode a plurality of previous frames, M is a measure of the motion present in a plurality of previous frames and the current frame, B_{dec} is a measure of the decoder buffer fullness, where F_{curr} and F_{sc} are the frame numbers of the current frame and the last scene-change frame respectively and T_{QM} , T_{B2} and T_{sc} are preset thresholds.

12. The method of claim 11, wherein the quantization measure is based on a rolling average of the quantization scales of a plurality of previous frames and the predicted quantization scale of the current frame.
13. The method of claim 11, wherein the quantization measure is based on a rolling average of the quantization scales of a plurality of previous frames, further the motion estimate is based on the rolling average of the motion measure of an individual frame, the measure being based on the energy of the motion-compensated residual of the frame and the motion vector magnitudes for the frame.
14. The method of claim 2, wherein the scene-change detection is based on the inter-YOR920030574US1

pixel difference and frame mean of two successive frames.

15. A method for predictively encoding digital video sequences, comprising:

dynamically selecting the resolution of the current frame being encoded, the selection being based on the statistical and coding information of a plurality of frames, including at least one previous frame and the current frame, the statistical information including scene-change information and estimated motion information, the coding information including a measure of the quantization used by the frames and a measure of the availability of bits, the statistical and coding information being generated by a previous run of a coder means;

selecting encoding parameters and encoding the current frame at a chosen resolution, taking into account the output of the dynamic resolution selection step in determining the encoding parameters.

16. A system for predictively encoding digital video sequences, comprising:

a dynamic resolution switch controller means for dynamically selecting the resolution of the current frame being encoded, the selection being based on the statistical and coding information of a plurality of frames;

a coder means for selecting encoding parameters and encoding the current frame at a chosen resolution, the coder means taking into account the output of the dynamic resolution switch controller means in determining the encoding parameters.

17. The system of claim 16, wherein the dynamic resolution switch controller means further utilizes at least one previous frame and the current frame, the statistical information including scene-change information and estimated motion

information, and the coding information including a measure of the quantization used by the frames and a measure of the availability of bits

18. The system of claim 17, wherein the decoder buffer fullness is determined by the measure of the availability of bits.
19. The system of claim 17, wherein the dynamic resolution is further based on functional conditions based on the statistical and coding information, on the basis of which the resolution selection is performed are different for a low-to-high resolution switch as compared to a high-to-low resolution switch.
20. The system of claim 18, wherein the coder means receives the output of the resolution switch controller means by coding the current frame non-predictively if the resolution switch controller means determines that the current frame be coded at a different resolution than the immediately preceding frame.
21. The system of claim 18, wherein the coder means receives the output of the resolution switch controller means by coding the current frame in a combined predictive and non-predictive fashion, with non-predictive coding favored, the decision between predictive and non-predictive coding taken on the basis of frame statistics for a plurality of previous frames and the current frame, if the resolution switch controller means determines that the current frame be coded at a different resolution than the immediately preceding frame.
22. The system of claim 21, wherein the statistics include an estimate of the motion, the estimate being based on motion information including the energy of the motion-compensated residual of the current frame.
23. The system of claim 19, wherein the functional criteria evaluated for determining if a high-to-low resolution switch be affected is given by the following condition,
YOR920030574US1

the switch being affected if the condition C₁ evaluates to TRUE

$$C_1 = \{ \{Q > T_Q\} \&\& \{M > T_M\} \} \text{ II } \{B_{dec} < T_B\}$$

where Q is a measure of the quantization scales used to encode a plurality of previous frames, M is a measure of the motion present in a plurality of previous frames and the current frame, B_{dec} is a measure of the decoder buffer fullness and T_Q, T_M and T_B are preset thresholds.

24. The system of claim 23, wherein the quantization measure is based on a rolling average of the quantization scales of a plurality of previous frames and the predicted quantization scale of the current frame.
25. The system of claim 23, wherein the quantization measure is based on a rolling average of the quantization scales of a plurality of previous frames, further, the motion estimate is based on the rolling average of the motion measure of an individual frame, the measure being based on the energy of the motion-compensated residual of the frame and the motion vector magnitudes for the frame.
26. The system of claim 19, wherein the functional criteria evaluated for determining if a low-to-high resolution switch be affected is given by the following condition, the switch being affected if the condition C₂ evaluates to TRUE

$$C_2 = \{Q.M_2 > T_{QM}\} \&\& \{B_{dec} > T_{B2}\} \&\& \{F_{curr} - F_{sc} > T_{SC}\}$$

where Q is a measure of the quantization scales used to encode a plurality of previous frames, M is a measure of the motion present in a plurality of previous frames and the current frame, B_{dec} is a measure of the decoder buffer fullness, F_{curr} and F_{sc} are the frame numbers of the current frame and the last scene-change
YOR920030574US1

frame respectively and T_{QM} , T_{B2} and T_{SC} are preset thresholds.

27. The system of claim 26, wherein the quantization measure is based on a rolling average of the quantization scales of a plurality of previous frames and the predicted quantization scale of the current frame.
28. The system of claim 26, wherein the quantization measure is based on a rolling average of the quantization scales of a plurality of previous frames, further, the motion estimate is based on the rolling average of the motion measure of an individual frame, the measure being based on the energy of the motion-compensated residual of the frame and the motion vector magnitudes for the frame.
28. The system of claim 17, wherein the scene-change detection is based on the inter-pixel difference and frame mean of two successive frames.
30. A system for predictively encoding digital video sequences, comprising:
 - a dynamic resolution switch controller means, for dynamically selecting the resolution of the current frame being encoded, the selection being based on the statistical and coding information of a plurality of frames, including at least one previous frame and the current frame, the statistical information including scene-change information and estimated motion information, and the coding information including a measure of the quantization used by the frames and a measure of the availability of bits, the statistical and coding information being generated by a previous run of a coder means;
 - a coder means, for selecting encoding parameters and encoding the current frame at a chosen resolution, the coder means taking into account the output of the

dynamic resolution switch controller means in determining the encoding parameters.

31. A computer program product for predictively encoding digital video sequences, comprising a computer-readable medium carrying thereon:

a means for dynamically selecting the resolution of the current frame being encoded, the selection being based on the statistical and coding information of a plurality of frames, including at least one previous frame and the current frame;

a means for selecting encoding parameters and encoding a current frame at a chosen resolution, the means taking into account the output of the means for dynamically selecting the resolution of the current frame being encoded in determining the encoding parameters.

32. The computer program product of claim 31, wherein the statistical information includes scene-change information and estimated motion information, and the coding information includes a measure of the quantization used by the frames and a measure of the availability of bits.
33. The computer program product of claim 31, wherein the means for dynamically selecting the resolution of the current frame being encoded further includes the step of the statistical and coding information being generated by a previous execution of the means for selecting encoding parameters and encoding the current frame at a chosen resolution.